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Integrated weed management in finger millet under rain-fed region

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ABSTRACT

Weed infestation is serious problem in cultivation of finger millet under upland situation. Two to three flushes of weeds during vegetative phase are common during rains. An experiment was conducted on finger millet during *kharif* season of 2005, 2006 and 2007 at S.G. College of Agriculture and Research Station, Jagdalpur. The experiment was laid out in randomized block design with twelve treatments. Weed population and dry matter accumulation by weeds was significantly varied due to weed control treatments in three years of experimentation. The maximum weed population of 120, 416 and 432 for broad leaf weeds and 916, 858 and 959 for narrow leaf weeds were found in weedy check in 2005, 2006 and 2007, respectively, while dry matter of 696, 663 and 662 g/m^2 for broad leaf weeds and 1271, 1134 and 514 g/m^2 for narrow leaf weeds was recorded. The application of pre-emergence spray of isoproturon 0.5 Kg/ha + two hand inter-cultivation (20 and 40 DAS) gave significantly minimum weed population and dry matter accumulation. Pre-emergence spray of isoproturon 0.5 kg/ha + two intercultivations (T_8) produced maximum grain yield (1902, 1887 and 1880 kg/ha) after hand weeding.

Key words : Integrated weed management,Isoproturon, Finger millet, *Kharif*- ragi, Intercultivation

Finger millet is grown in *kharif* for grain purpose and it is the only millet among small millet, which is consumesd directly after threshing as whole grain. Weed infestation is serious problem in cultivation of finger millet under upland situation. Two to three flushes of weeds during vegetative phase of crop is common with occurrence of rain. The growing habit of finger millet is rigorous but initially it is suppressed by weeds. Although hand weeding is quite effective in minimizing the infestation, but it is difficult to practice during rainy season. Therefore, weed control through herbicides seems to be the possible measure for reducing wide range of weeds in short time and in economical way. The lack of information on appropriate herbicidal weed management practices necessitated this study in the region.

MATRIALS AND METHODS

An experiment was conducted on finger millet during *kharif* season of 2005, 2006 and 2007 at S.G. College of Agriculture and Research Station, Jagdalpur. The experiment was laid out in randomized block design with twelve treatments *viz.,* T_1- Pre-emergence spray of isoproturon 0.005 kg/ha, T_2- Pre-emergence spray of isoproturon 0.05 kg/ha, T_3- Pre-emergence spray of Isoproturon 0.5 kg/ha, T_4- T_1 + two inter-cultivations, T_5- T_1 + two inter-cultivations and one hand weeding, T_6- T_2 + two inter-cultivations, T_7 - T_2 + two inter-cultivations and one hand weeding, T_8 - T_3 + two inter-cultivations, T_9 - T_3 + two inter-cultivations and one hand weeding, T_{10} - Two intercultivations + one hand weeding, T_{11} - Weed free check and T_{12} - Weedy check in three replications. The finger millet variety "*Ratnagiri*" was taken as test variety and 10 kg per hectare was sown at 30 cm distance of rows. The crop was fertilized with 60:30:20 kg/ha NPK through urea, single super phosphate and murate of potash. Weed samples were collected by random placing of 50 x 50 cm quadrate in each plot at monthly interval. Weeds were cut down at ground levels and then identified, counted and the samples were kept in an oven at 70± 1^{0}C until they attained constant weight. The crop growth and yield attributing characters of finger millet were also recorded at different stages of crop. The data on weeds populations were square root transformed $\sqrt{x + 0.5}$ for statistical analysis (Panse and Sukhatme 1967).

RESULTS AND DISCUSSION

Effect on crop

Plant height (77.23, 104.60, 112.97 cm), number of tiller per plant (3.23, 3.73, 3.40), number of finger (6.74, 5.90, 6.30) and 1000 grain weight (3.30, 4.08, 3.91g) significantly varied due to different weed management practices during 2005, 2006 and 2007, respectively. T_8 - Pre-emergence spray of isoproturon 0.5 kg/ha + two inter-cultivations was significantly higher than other treatments in three years. Application of T_8 produced maximum grain yield (1902, 1887 and 1880 kg/ha during 2005, 2006 and 2007, respectively) after hand weeding being at par with T_4 and T_6 (Table 1 and 2). These observations showed

Table 1. Influence of integrated weed management on plant height, number of tiller, number of finger and 1000 grain weight of finger millet

Treatments	Plant height (cm)			Number of tiller/plant			Number of finger/plant			1000 grain wt. (g)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
T_1 - Pre-emergence spray of isoproturon 0.005kg/ha	51.7	96.6	103.1	3.2	1.6	2.4	4.2	5.8	5.3	2.9	3.5	2.9
T_2 - Pre-emergence spray of isoproturon 0.05kg/ha	61.3	96.3	104.1	2.3	1.7	2.3	5.2	5.6	5.7	2.5	3.0	2.9
T_3 - Pre-emergence spray of isoproturon 0.5kg/ha	53.0	102.4	101.6	3.0	1.5	2.3	5.1	5.9	5.8	2.4	3.4	2.8
T_4 - T_1 + two inter-cultivations	66.9	93.3	105.7	3.5	2.1	2.5	5.6	5.6	5.1	2.7	3.2	3.1
T_5 - T_1 + two inter-cultivations and one hand weeding	62.9	96.1	102.9	2.9	2.5	2.3	5.9	5.9	5.8	2.5	3.4	3.5
T_6 - T_2 + two inter-cultivations	66.7	94.3	104.9	2.0	2.5	2.2	5.8	5.4	5.6	2.9	3.5	3.3
T_7 - T_2 + two inter-cultivations and one hand weeding	70.1	76.6	104.4	2.1	2.6	2.4	5.8	5.7	5.9	3.0	3.0	3.5
T_8 - T_3 + two inter-cultivations	77.2	104.6	113.0	3.2	3.3	3.1	6.3	6.2	5.9	3.3	4.0	3.8
T_9 - T_{13} + two inter-cultivations and one hand weeding	65.7	89.0	108.3	2.6	3.3	2.2	6.2	5.6	6.0	3.2	3.6	3.3
T_{10} - Two inter-cultivations + one hand weeding	66.8	96.6	103.8	2.2	1.5	3.4	5.7	5.5	5.9	2.9	3.5	3.4
T_{11} - Weed free check	62.8	101.9	114.5	3.6	3.7	3.4	6.7	6.3	6.3	3.4	4.1	3.9
T_{12} - Unweeded check	54.4	94.9	101.3	2.4	2.4	2.3	3.6	5.5	5.3	2.9	2.9	3.4
LSD (P=0.05)	9.0	10.0	3.1	0.4	0.3	0.3	0.5	0.0	0.3	0.3	0.1	0.1

Table 2. Influence of integrated weed management on yield and yield attributing characters of finger millet

Treatments	Grain yield (kg/ha)			Straw yield (kg/ha)			Harvest index (%)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
T_1 - Pre-emergence spray of isoproturon 0.005kg/ha	1425	1639	1551	3563	4198	3778	60.01	60.96	58.95
T_2 - Pre-emergence spray of isoproturon 0.05kg/ha	1422	1635	1815	3600	3888	4038	60.50	57.95	55.05
T_3 - Pre-emergence spray of isoproturon 0.5kg/ha	1664	1814	1550	4220	4035	3975	60.57	55.04	61.01
T_4 - T_1 + two inter-cultivations	1923	1887	1880	4655	4418	4200	58.69	57.29	55.24
T_5 - T_1 + two inter-cultivations and one hand weeding	1522	175	1640	3890	4075	4100	60.87	57.06	60.00
T_6 - T_2 + two inter-cultivations	1892	1776	1910	4830	4340	4675	60.83	59.08	59.14
T_7 - T_2 + two inter-cultivations and one hand weeding	1608	1849	1545	4120	4323	4063	60.97	57.23	61.97
T_8 - T_3 + two inter-cultivations	1902	2211	2109	4708	5328	4873	59.60	58.50	56.72
T_9 - T_{13} + two inter-cultivations and one hand weeding	1679	1931	1879	4298	4528	4498	60.94	57.35	58.23
T_{10} - Two inter-cultivations + one hand weeding	1649	1896	1748	4223	4140	4370	60.95	54.20	60.00
T_{11} - Weed free check	2067	2415	2408	5268	5538	5220	60.76	56.39	53.87
T_{12} - Unweeded check	625	897	589	1563	2043	1573	60.01	60.96	58.95
LSD (P=0.05)	363	287	304	533	489	431	-	-	-

Table 3. Influence of integrated weed management on weed density and dry matter accumulation of weeds

Treatments	Density of weeds/m^2						Dry weight of weeds (g/m^2)					
	Broad leaf			Grasses			Broad leaf			Grasses		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
T_1 - Pre-emergence spray of isoproturon 0.005kg/ha	17.0 (289)	14.3 (204)	14.8 (218)	21.2 (449)	15.0 (225)	15.0 (224)	23.74 (563)	23.25 (540)	23.84 (567)	19.23 (369)	24.41 (595)	24.20 (585)
T_2 - Pre-emergence spray of isoproturon 0.05kg/ha	18.9 (357)	19.0 (359)	19.4 (373)	21.0 (441)	14.2 (201)	14.2 (202)	24.36 (593)	23.83 (567)	23.28 (541)	18.54 (343)	24.83 (616)	23.81 (566)
T_3 - Pre-emergence spray of isoproturon 0.5kg/ha	17.4 (302)	17.6 (308)	18.0 (321)	19.4 (377)	18.6 (346)	18.7 (347)	21.55 (464)	21.28 (452)	21.33 (454)	22.11 (488)	22.13 (489)	21.61 (466)
T_4 - T_1 + two inter-cultivations	17.2 (293)	17.3 (300)	17.7 (313)	19.5 (381)	18.7 (348)	18.7 (350)	21.06 (443)	20.80 (432)	20.91 (436)	22.42 (502)	22.40 (501)	21.86 (477)
T_5 - T_1 + two inter-cultivations and one hand weeding	12.6 (157)	12.8 (163)	13.3 (176)	15.2 (232)	20.2 (407)	20.2 (406)	17.87 (319)	17.54 (307)	20.05 (401)	24.55 (602)	19.27 (371)	17.94 (321)
T_6 - T_2 + two inter-cultivations	18.6 (345)	18.6 (347)	19.1 (361)	15.9 (254)	20.3 (413)	20.3 (411)	20.60 (424)	20.04 (401)	17.61 (309)	24.99 (624)	18.56 (344)	18.59 (345)
T_7 - T_2 + two inter-cultivations and one hand weeding	11.4 (128)	11.6 (134)	12.2 (147)	15.1 (228)	15.7 (247)	14.0 (194)	17.30 (299)	16.90 (285)	16.94 (286)	19.36 (374)	22.20 (492)	21.44 (499)
T_8 - T_3 + two inter-cultivations	10.9 (118)	11.2 (124)	11.8 (137)	17.0 (287)	14.0 (194)	15.6 (244)	16.56 (274)	16.24 (263)	16.34 (266)	22.66 (513)	19.20 (368)	18.51 (342)
T_9 - T_{13} + two inter-cultivations and one hand weeding	11.1 (122)	11.3 (128)	11.9 (141)	17.6 (309)	16.3 (265)	16.2 (263)	16.86 (284)	16.51 (272)	16.58 (274)	23.66 (559)	23.14 (535)	22.36 (459)
T_{10} - Two inter-cultivations + one hand weeding	14.3 (203)	17.1 (293)	17.5 (306)	19.8 (391)	18.9 (356)	18.9 (356)	21.90 (479)	21.49 (461)	21.57 (464)	23.44 (549)	23.30 (542)	21.49 (461)
T_{11} - Weed free check	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T_{12} - Unweeded check	20.5 (420)	20.4 (416)	20.8 (432)	30.3 (916)	29.3 (858)	31.0 (959)	26.39 (696)	25.76 (663)	25.75 (662)	35.66 (1271)	33.69 (1134)	28.80 (514)
LSD (P=0.05)	3.2	0.3	0.2	0.5	0.4	0.4	0.36	0.12	0.32	0.11	0.40	0.75

*Figures in parenthesis denote original values.

suppression of weeds with more ground space. All the treatments had higher grain yield than unweeded check and lower than weed free plot due to highest level of weed suppression and lower weed pressure over test crop. This could be explained on the basis of its favourable influence on sink capacity and its effective translocation toward the yield attributes under hand weeding twice. Similar finding were given by Singh and Singh (1984). Finger millet suppressed the weeds in later growing period if initial support was given through smothering the weeds. These findings were also in conformity with the results of Mahabaleshwar (1983), Singh (1987) and Mukherjee *et al*. (2000). The finger millet yield was reduced corrosponding to rise in weed density and dry matter of weed which caused more significant reduction in yield as compared to weed free treatment (Nanjappa 1980).

Alone application of pre-emergence spray of isoproturon 0.5 kg/ha recorded higher grain yield (1664, 1814 and 1550 kg/ha in 2005, 2006 and 2007, respectively) with harvest index of 60.57, 60.96 and 61.01% during 2005, 2006 and 2007, respectively, in comparison to lower doses of isoproturon (0.005 and 0.05 kg/ha).

Effect on weeds

The predominant weeds found in weedy check plot were *Echinochloa colona, Digitaria sangunalis, Cyperus rotundus* as narrow leaf weeds and *Eleusine indica, Celosia argentia, Commelina benghalensis*, *Euphorbia geniculata* as broad leaf weeds. Weed population and dry matter accumulation of weeds significantly varied due to weed control treatments in three years of experimentation. The maximum weed population of 420, 416 and 432 for broad leaf weeds and 916, 858 and 959 for narrow leaf weeds was found in weedy check in 2005, 2006 and 2007, respectively. Dry matter of 696, 663 and 662 g/m^2 for broad leaf weeds and 1271, 1134 and 514 g/m^2 for narrow leaf weeds was recorded. These results were in conformity with Billore *et al.* (1999). The application of pre-emergence spray of isoproturon 0.5 Kg/ha + two inter-cultivation (20 and 40 DAS) resulted significantly minimum weed population and dry matter accumulation, being at par with T_7 (T_2 + two inter-cultivations and one hand weeding) for controlling broad spectrum weed flora. Similar trend was observed in narrow leaf weeds also. When herbicides were applied in combination, they checked wide range of weeds than alone. Similar results were also reported by Singh and Singh (1984). Treatments T_1 and T_5 were observed to be inferior that of T_{10} and T_{11} to reduce weed biomass. On the other hand, T_4, T_7 and T_8 were closer in controlling broad and narrow leaf weeds (Table 3). Higher weed control efficiency (71.90, 70.19 and 68.29% in 2005, 2006, 2007, respectively) was found in pre-emergence spray of isoproturon 0.5 kg/ha + two

Table 4. Influence of integrated weed management on weed control efficiency

Treatments	Broad-leaved weeds (BLW)			Narrow-leaved weeds (NLW)		
	2004	2005	2006	2004	2005	2006
T_1 - Pre-emergence spray of isoproturon 0.005kg/ha	31.19	50.96	49.54	50.98	73.78	76.64
T_2 - Pre -emergence spray of isoproturon 0.05kg/ha	15.00	13.70	13.66	51.86	76.57	78.94
T_3 - Pre -emergence spray of isoproturon 0.5kg/ha	28.10	25.96	25.69	58.84	59.67	63.82
T_4 - T_1 + two inter-cultivations	30.24	27.88	27.55	58.41	59.44	63.50
T_5 - T_1 + two inter-cultivations and one hand weeding	62.62	60.82	59.26	74.67	52.56	57.66
T_6 - T_2 + two inter-cultivations	17.86	16.59	16.44	72.27	51.86	57.14
T_7 - T_2 + two inter-cultivations and one hand weeding	69.52	67.79	65.97	75.11	71.21	79.77
T_8 - T_3 + two inter-cultivations	71.90	70.19	68.29	68.67	77.39	74.56
T_9 - T_3 + two inter-cultivations and one hand weeding	70.95	69.23	67.36	66.48	69.11	72.58
T_{10} - Two inter-cultivations + one hand weeding	51.67	29.57	29.17	57.31	58.51	62.88
T_{11} - Weed free check	100.00	100.00	100.00	100.00	100.00	100.00
T_{12} - Unweeded check	0.00	0.00	0.00	0.00	0.00	0.00

inter-cultivation over rest of treatments for broad leaf weeds. Narrow leaf weeds were suppressed effectively by isoproturon 0.05 kg/ha as pre-emergence + two inter-cultivation + one hand weeding with weed control efficiency of 75.11, 77.39 and 79.77% in 2005, 2006 and 2007, respectively (Table 4).

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